QUBEE ACADEMY

CHEMISTRY EUEE 2011/2019 ANSWER

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1. When Na_2CrO_4 solution is acidified, which of the following is formed?
   (A) Cr (metal) (B) Cr_2O_3 (C) $Cr_2O_7^{2-}$ (D) $Cr0_4^{2-}$

   EXPLANATION:

2. What makes the phosphorus cycle different from the carbon and nitrogen cycles?
   (A) Carbon and nitrogen are found in the atmosphere in the gaseous state .
   (B) Carbon and nitrogen are released at lower rate compared to phosphate salts.
   (C) Phosphorus salts are released at higher rate compared to carbon and nitrogen cycles.ZXC vbnm,.
   (D) Phosphorus is found in the atmosphere in the gaseous state.

   EXPLANATION:

   - The phosphorus cycle differs from the nitrogen and carbon cycles primarily in that phosphorus is not found in the atmosphere in the gaseous state, but Carbon and nitrogen are found in the atmosphere in the gaseous state .
   - In comparison to the nitrogen and carbon cycles, the rate at which phosphate salts are released is extremely slow.

   ANSWER: A

3. Which of the following can function as both a bronsted-Lowry acid and bronsted-Lowry base?
   (A) H_2SO_4 (B) H^+ (C) SO_4^{2-} (D) HSO_3^-

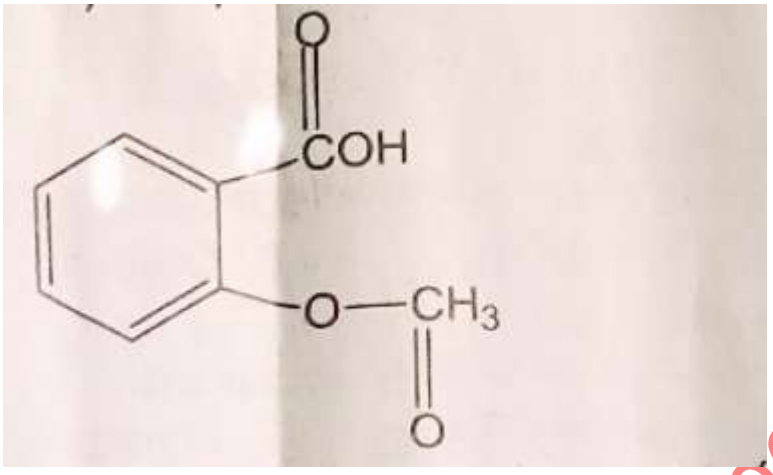
   EXPLANATION:

4. Which of the four colligative properties arises in systems where there is an equilibrium between a liquid solution phase and a second liquid phase?
   (A) Vapour pressure lowering (C) Freezing point depression
   (B) Osmotic pressure (D) Boiling point elevation

   EXPLANATION:

   ANSWER:

5. Acetylsalicylic acid (aspirin) has the structural formula:



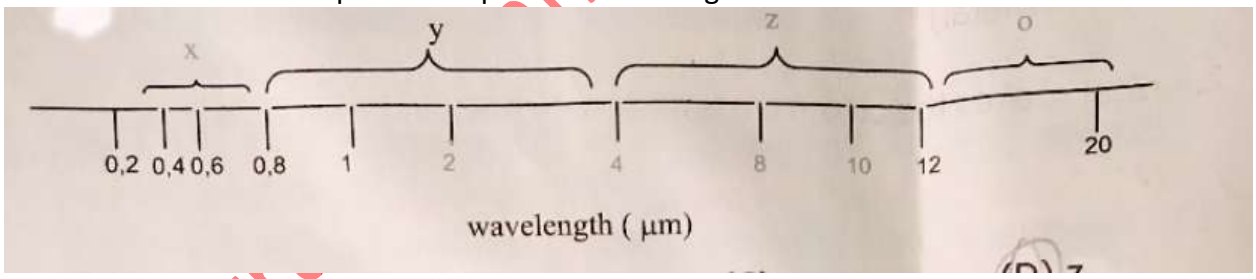
Which functional group(groups) is (are) present in aspirin?

(A) Hydroxyl
(B) Hydroxyl and carbonyl
(C) Carboxyl and ester
(D) Carboxyl and acetyl

EXPLANATION: ***Aspirin*** contains two funcational groups – COOH(funcational group of carboxylic acid) and – OOC – (funcational group of ester)

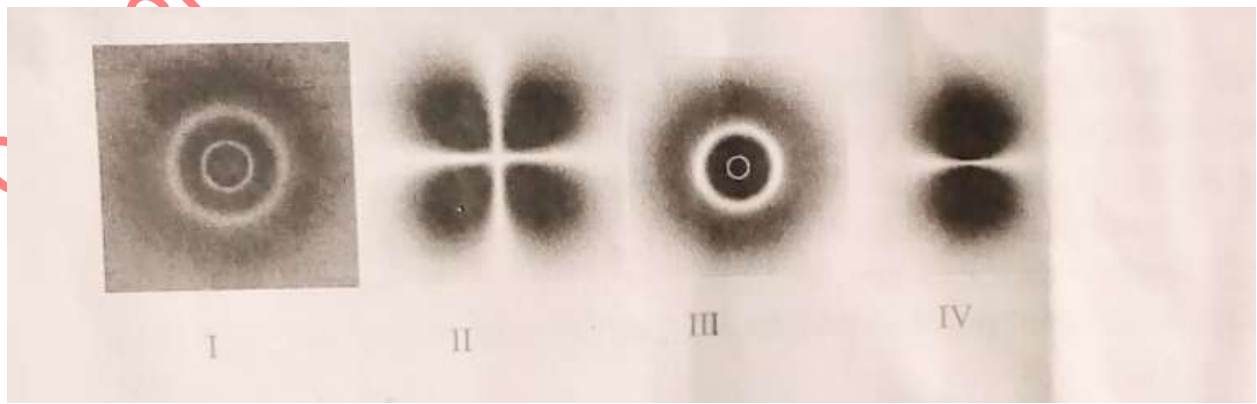
ANSWER: C

6. In the electromagnetic spectrum with wavelength shown (in micrometers,), which bracketed section of the spectrum represents visible light



(A) X (B) O (C) Y (D) Z

7. Which of the orbitals in the figure below has (have) an angular momentum quantum number of $\ell = 2$?



(A) I (B) I and III (C) I and IV (D) II

8. What is the first step in a scientific investigation?

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(A) Make observations (C) Do research
(B) Ask questions (D) Draw conclusions

EXPLANATION: the first step in a scientific investigation is making observation.

ANSWER: A

9. Which of the following is the SI measurement unit of electric current?
(A) Watt (B) Ampere (C) Volt (D) Coulomb

EXPLANATION: The SI unit of electric current is Ampere.

ANSWER: B

10. Which of the following is **NOT** a component of a polysaccharides?
(A) Glucose (B) Cellulose (C) Sucrose (D) Glycogen

EXPLANATION: The three important polysaccharides, all made up of glucose units, are cellulose, starch and glycogen.
Sucrose is not a component of polysaccharides.

ANSWER: C

11. Nylon is a/an ____ ?
(A) Amide (B) Peptide (C) Polyester (D) Polyamide

EXPLANATION: Nylons are polyamides.

ANSWER: D

12. The metal extracted from limestone, chalk and marble is _____ .
(A) Calcium (B) Sodium (C) ZINC (D) Chromium

EXPLANATION: metals are extracted from their ores.
The main ores of calcium are: limestone, chalk, and marble ($CaCO_3$), dolomite ($CaCO_3.MgCO_3$), gypsum ($CaSO_4.2H_2O$), fluorite (CaF_2), and hydroxylapatite, $Ca_5(PO_4)_3OH$.

ANSWER: A

13. Which one of the following is **NOT** a condensation polymer?
(A) Nylon (B) Polyamides (C) Polyester (D) Neoprene

EXPLANATION:

- Neoprene, Polyethylene, Polyvinyl Chloride (PVC), Polypropylene,
  Polymethyl methacrylate (Perspex), Teflon, Polystyrene are examples of ADDITION polymers.
- Nylons(polyamides), Polyester are examples of CONDENSATION polymers.

ANSWER: C

14. Which of the following compounds does **NOT** contain both ionic and covalent bond?
(A) NH_4NO_3 (B) Na_2CO_3 (C) CH_3CO_2H (D) NH_4Cl

EXPLANATION:

- ❖ Ionic bond is formed between metal (or some time ammonium ion) and one or more non-metal elements.
- ❖ Covalent bond is formed between two or more non-metal elements.

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❖ The bond in CH_3CO_2H is formed only from non metal elements.

ANSWER: C

15. What aspect of the modern view of the atomic structure was proved by Rutherford's gold foil experiment?
    (A) The charge on an α particle.
    (B) The charge on an electron.
    (C) The existence of the nucleus.
    (D) The existence of electrons.

ANSWER: C

16. Which of these compounds in propanoic acid?
    (A) CH_3CH_2COOH (C) $CH_3CH_2CH_2OH$
    (B) CH_3CH_2COH (D) $CH_3CH_2COOCH_3$

EXPLANATION: propanoic acid is a carboxylic acid which has 3 carbon atom and – COOH as its functional group.

ANSWER: A

17. Fats and oils can be classified as _____ .
    (A) carbohydrates (B) esters (C) acids (D) alcohols

EXPLANATION: Oils, fats and waxes of plants or animal are classified as ESTERS.

ANSWER: B

18. What does it mean by ΔH = negative for a given process?
    (A) The process is endothermic
    (B) The process is equithermic
    (C) The process is adiabatic
    (D) The process is exothermic

EXPLANATION: The negative value of ΔH indicates the process is an exothermic reaction.

ANSWER: D

19. The oxidation state of chlorine in $HClO_4$ is:
    (A) +7 (B) +3 (C) +5 (D) +1

SOLUTION:

$$\overset{+1\ \ x\ \ -2}{HClO_4} \quad \Longrightarrow 1 + x + (-2)(4) = 0$$
$$\Longrightarrow 1 + x - 8 = 0$$
$$\Longrightarrow x = +7$$

ANSWER: A

20. Which substance is used to lower the melting point of the aluminum oxide ore in the electrolytic extraction of aluminum?
    (A) Hematite (B) Bauxite (C) Cryolite (D) Magnetite

21. Which of the following type of bonding exists between atoms with very different electro negativities?
    (A) Metallic bonding (C) Ionic bonding
    (B) Hydrogen bonding (D) Network covalent bonding

EXPLANATION: ionic compounds result from the packing of the oppositely charged

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positive and negative ions together. They have very different electro negativities.

ANSWER: C

22. Which of the following elements has the highest fifth ionization energy(IE_5)?
(A) Al (B) S (C) P (D) SI

23. Consider the following two possibilities for electron transfer in a hydrogen atom, given below:
First: The electron drops from the Bohar orbit n= 3 to the orbit n=2, followed by the Transition from n=2 to n= 1.
Second: The electron drops from the Bohar orbit n= 3 directly to the orbit n=1.
Which of the following is correct about the energy change of these transitions?
(A) The sum of the energies for the first transitions is less than the energy of transition of the second.
(B) The sum of the energies for the first transitions is greater than the energy of transition of the second.
(C) The sum of the energies for the first transitions is equal to than the energy of transition of the second.
(D) The energies of transitions of the first and the energy of transition of the second can't be compared.

24. precision refers to _____ .
(A) how close a measured number is to the true value.
(B) how close a measured number is to other measured numbers.
(C) how close a measured number is to zero.
(D) how close a measured number is to the calculated value.

EXPLANATION: Precision is a measure of how clearly individual measurements agree with one another.

ANSWER: B

25 Which of the following is the correct reaction taking place at the electrodes during the electrolysis of dilute sodium chloride solution?

(A) Anode: $2\ H_20\ (l) \longrightarrow O_2\ (g) + 4H^+\ (aq) + 4e^-$
Cathode: $2H_2O(l) + 2e^- \longrightarrow H_2(g) + OH^-(aq)$

(B) Anode: $2Cl^-\ (aq) \longrightarrow Cl_2\ (l) + 2e^-$
Cathode: $2Na^+(aq) + 2e^- \longrightarrow 2Na(s)$

(C) Anode: $2Cl^-\ (aq) \longrightarrow Cl_2\ (l) + 2e^-$
Cathode: $2\ H_20\ (l) + 2e^- \longrightarrow H_2\ (g) + OH\text{-}(aq)$

(D) Anode: $2\ H_20\ (l) \longrightarrow O_2\ (g) + 4H^+\ (aq) + 4e^-$
Cathode: $2Na^+\ (aq) + 2e^- \longrightarrow 2Na(s)$

EXPLANATION: Dilute sodium chloride solution contains Na^+, Cl^-, H^+ and OH^- ions. When a potential difference is applied across the two electrodes (anode and cathode), Na^+ and H^+ ions migrate towards the cathode, and OH^- and Cl^- ions migrate

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towards the anode. At the cathode, H^+ ions are discharged, in preference to Na^+ ions because the hydrogen ion is below the Na^+ ion in the electrochemical series and at the anode, OH^- ions are discharged in preference to Cl^- ions because the hydroxide ion is below the Cl^- ion in the electrochemical series.

Anode (oxidation): $4OH^-(aq) \longrightarrow 2H_2O(l) + O_2(g) + 4e^-$ Or

$2\ H_2O\ (l) \longrightarrow O_2\ (g) + 4H^+\ (aq) + 4e^-$

Cathode (reduction): $2H^+(aq) + 2e^- \longrightarrow H_2(g)$ Or

$2H_2O(l) + 2e^- \longrightarrow H_2(g) + 2OH^-(aq)$

ANSWER: A

26. When a saturated solution of sodium chloride is heated, it becomes _____.

(A) unsaturated (C) Attains equilibrium conditions

(B) Remains saturated (D) Supersaturated

27. The PH of a solution prepared by the addition of 100mL 0.002M HCl to 100mL distilled water is closest to:

(A) 1.0 (B) 3.0 (C) 2.0 (D) 1.5

EXPLANATION: first let find concentration(M_2) of the prepared solution.

$M_1 = 0.002M$ $V_1 = 100mL$

$V_2 = V_1 + V_{H2O} = 100mL + 100mL = 200mL$

$M_1V_1 = M_2V_2$

$M_2 = \frac{M_1V_1}{V_2} = \frac{(0.002)(100)}{200} = 0.001M$

Since HCL is strong acid it completely ionized, thus $[H^+] = [Cl^-] = [HCl] = 0.001M$

$PH = -\log[H^+] = -\log(0.001) = 3$

ANSWER: B

28. Hydrolysis of ester leads to the formation of which of the following products in basic medium?

(A) Ether and alcohol (C) Sodium carboxylate

(B) Aldehyde and alcohol (D) Alcohol and sodium carboxylate

EXPLANATION: Esters undergo base-catalyzed hydrolysis to give salts of carboxylic acids(i.e sodium carboxylate or potassium carboxylate) and alcohols.

ANSWER: D

29. A sealed isothermal container initially contained 2 moles of CO gas and 3 moles of H_2 gas. The following reversible reaction occurred:

$CO\ (g) + 2H_2\ (g) \rightleftharpoons CH_3OH(g)$

At equilibrium, there was 1 mole of CH_3OH in the container. What was the total number of moles of gas present in the container at equilibrium?

(A) 1 (B) 2 (C) 3 (D) 4

30. Which one of following reactions at equilibrium would be unaffected by an increase in pressure?

(I) $N_2\ (g) + 3H_2\ (g) \rightleftharpoons 2NH_3(g)$

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(II) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$
(III) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
(IV) $2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$

(A) I (B) II (C) IV (D) III

31. Considering only resonance structure that are major contributors to the overall bonding in PF_5, which of the following statement is correct?
(A) There are no resonance structures that involve ionic contributions.
(B) In each resonance structure, the P atom carries a positive charge.
(C) Only three resonance structures can be drawn for PF_5.
(D) One resonance structure contains five P – F bonds.

32 4 L of 0.02M of aqueous solution of NaCl is diluted with 1L of water. What is the molarity of the solution?
(A) 0.016 (B) 0.008 (C) 0.012 (D) 0.004

SOLUTION: $M_1V_1 = M_2V_2$
$M_1 = 0.02M$, $V_1 = 4L$ and $V_2 = V1 + 1L = 4L + 1L = 5L$, $M_2 = ?$
$M_1V_1 = M_2V_2$
$M_2 = \frac{M_1V_1}{V_2} = \frac{(0.02)(4)}{5} = 0.016M$

ANSWER: A

33. How much water, in liters, must be added to 0.50 liter of 6.0 M HCl to make the solution 2.0M?
(A) 0.50 (B) 1.5 (C) 1.0 (D) 2.0

SOLUTION: $V_{H2O} = ?$, $V_1 = 0.5L$, $M_1 = 6.0M$, $M_2 = 2.0M$,
$V_2 = V_1 + V_{H2O} = 0.5L + V_{H2O}$
$\Longrightarrow M_1V_1 = M_2V_2$
$\Longrightarrow M1V1 = M2(0.5L + V_{H2O}$
$\Longrightarrow V_{H2O} = \frac{M_1V_1}{M_2} - 0.5L = \frac{(6)(0.5)}{2} - 0.5 = 1.5 - 0.5 = 1.0L$

ANSWER: C

34. What is the PH of a 0.10M solution of NH_3, a weak base, whose $K_b = 1.8x\ 10^{-5}$?
(A) 2.89 (B) 11.11 (C) 9.24 (D) 4.76

SOLUTION:
ANSWER:

35. Which group in the periodic table form ionic bonds?
(A) Groups 1(1A) and 17(7A), Groups 2(2A) & 16(6A)
(B) Groups 1(1A) and 7(7B), Groups 2(2A) & 6(6B)
(C) Groups 1(1A) and 18(8A), Groups 4(4B) & 14(4A)
(D) Groups 3(3B) and 5(5B), Groups 4(4B) & 14(4A)

EXPLANATION: ionic bond is the bond formed between one metal and one or more non- metal elements

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ANSWER: A

36. There is a progressive decrease in the bond angle in the series of molecules CCl_4, PCl_3, and H_20 . According to the VSEPR model, this is best explained by:

(A) Increasing electronegativity of the central atom
(B) Decreasing bond strength
(C) Decreasing size of the central atom
(D) Increasing number of lone pair electrons

EXPLANATION:

ANSWER:

37. For the reaction, $N_2 + 3H_2 \longrightarrow 2NH_3$, the rate of disappearance of H_2 is 0.01 mol L^{-1} min^{-1}. What is the rate of disappearance of NH_3?

(A) 0.01 mol L^{-1} min^{-1}
(B) 0.007 mol L^{-1} min^{-1}
(C) 0.02 mol L^{-1} min^{-1}
(D) 0.002 mol L^{-1} min^{-1}

SOLUTION:

ANSWER:

38. The appropriate unit for a first order rate constant are?

(A) M/s (B) 1/Ms (C) 1/s (D) $1/M^2s$

39. $$2X\,(g) \rightleftharpoons 3Y(g) + Z(g) \quad \Delta H_{\text{(forward rxn)}} > 0$$

The molar equilibrium concentrations for the reaction mixture represented above at 298 K are [X] =4.0M, [Y] = 5.0M [Z] = 2.0M. What is the value of the equilibrium constant, Keq , for the reaction at 298 K?

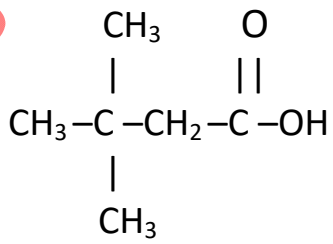
(A) 0.06 (B) 16.0 (C) 2.50 (D) 62.5

SOLUTION:

ANSWER:

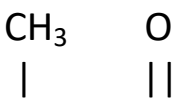
40. What is the IUPAC name for the following carboxylic acid?

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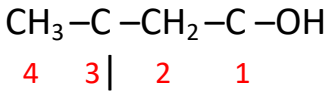


(A) 3-methylpentanoic acid
(B) 2-methylpentanoic acid
(C) 2,2-dimethylbutanoic acid
(D) 3,3-dimethylbutanoic acid

EXPLANATION: Since its has functional group of –COOH its carboxylic acid.
To name it sign number starting from carbonyl group to longest chain containing the –COOH.



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3,3-dimethylbutanoic acid

ANSWER: D

41. If a solution of acetic acid (CH_3COOH) has a pH of 3.00, what is its concentration? Ka = $1.74x10^{-5}$

(A) 0.057 M (B) 0.0057 M (C) 0.57 M (D)5.70M

SOLUTION: $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

first find the concentration of H_3O^+ from the given pH.

$pH = -\log[H_3O^+]$

$3 = -\log[H_3O^+]$

$[H_3O^+] = 10^{-3} = 0.001M$

$[CH_3COO^-] = [H_3O^+] = 0.001M$, at equilibrium

Know Ka = $\frac{[CH3COO-]\,[H3O+]}{[CH3COOH]}$

$\Longrightarrow [CH_3COOH] = \frac{[CH3COO^-]\;[H3O^+]}{Ka} = \frac{(0.001)(0.001)}{1.74x10^{-5}} = 0.057M$

ANSWER: A

42. How many grams of iodine, I_2, must be dissolved in 225.0mL of carbon disulfide, CS_2 (density = 1.261 g/cm3), to produce a 0.116 m solution?

(A) 4.84 g (B) 4.17g (C) 6.32g (D) 11.71g

43. In which of the following cases will the dissolution of sugar be the most rapid?

(A) Sugar crystals in hot water.
(B) Powdered sugar in cold water.
(C) Sugar crystals in cold water.
(D) Powdered sugar in hot water.

44. Which one of the following statements regarding a dynamic equilibrium is **FALSE**?

(A) At equilibrium, there is no net change in the system.
(B) At equilibrium, the rates of the forward and reverse reactions are identical.
(C) At equilibrium, the forward and reverse reactions cease to occur.
(D) At equilibrium, the concentrations of reactants and products stays the same

45. The proposed reaction mechanism between nitrogen monoxide and bromine is given below.

$NO + Br_2 \rightleftharpoons NOBr_2$(fast)

$NOBr_2 + NO \longrightarrow 2NOBr_2$(slow)

Which of the following rate equations is consistent with the proposed mechanism?

(A) Rate = $k[NO]^2$ (C) Rate = $K[NO][Br_2]$
(B) Rate = $K[NO]^2[Br_2]$ (D) Rate = $K[NO][Br_2]^2$

46. The minimum energy required for an effective collision is called ———— .

(A) potential energy (C) activation energy
(B) free energy (D) kinetic energy

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EXPLANATION: The minimum energy required for a reaction to occur during a collision of reacting species is called the activation energy, E_a.

ANSWER: C

47. A sample of solid ammonium carbamate is heated in a closed container at 298 K and allowed to reach equilibrium.

$$NH_4CO_2NH_2\ (s) \rightleftharpoons 2NH_3\ (g) + CO_2\ (g)$$

If the total pressure of the system is 0.114 atm , what is the value of equilibrium constant, Kp?

(A) $2.19X10^{-4}$ (C) $7.60X10^{-3}$

(B) $3.80X10^{-4}$ (D) $1.29X10^{-3}$

SOLUTION: let first find partial pressure of each NH_3 ana CO_2 from the given total pressure.

$$Kp = (P_{NH3})^2(P_{CO2})^1 = ($$

ANSWER: A

48. Which of the following statements is correct about nitrosyl chloride (NOCl)?

(A) It has a bent or angular geometry with O a central atom.
(B) It has a bent or angular geometry with N a central atom.
(C) It has a trigonal planar geometry with N a central atom.
(D) It has a trigonal planar geometry with O a central atom.

49. Which of the following is **NOT** true about the photoelectric effect?

(A) Most metals require ultraviolet light to emit electrons.
(B) A bright causes more electrons to be emitted than a weak light.
(C) A bright causes less electrons to be emitted than a weak light.
(D) Higher frequency light emits electrons with higher kinetic energy.

50. A nickel electrode can undergo oxidation to Ni^{2+} ion as follows:

$$Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^- \quad E^0_{red} = -0.28\ V$$
$$2H_2O(l) \longrightarrow 4H^+(aq) + O_2(g) + 4e^- \quad E^0_{red} = 1.23\ V$$

What will happen during the electrolysis of concentrated aqueous solution of $NiSO_4$ using Ni electrodes?

(I) Nickel will deposit at the cathode.
(II) Nickel will dissolve at the anode.
(III) Oxygen will be released at the anode.
(IV) Nickel will be deposit at the anode.

(A) I only (B) I, III (C) I, II (D) II, IV

51. The inductor methyl red is in a solution of NaH_2PO_4, which of the following equations is consistent with this observation?

(A) $H_2PO_4^- + H_20 \rightleftharpoons HPO_4^{2-} + H_30^+$
(B) $H_2PO_4^- + H_20 \rightleftharpoons H_3PO_4 + OH^-$
(C) $HPO_4^{2-} + H_2O \rightleftharpoons PO4^{3-} + H_3O^+$

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(D) $HPO_4^{2-} + H_20 \rightleftharpoons H_2PO_4^- + OH^-$

52. The sublevel that can be occupied by a maximum of 10 electrons is identified by the letter ———— .

(A) s (B) f (C) p (D) d

ANSWER: D

53. What is the molecular shape of ICl_4^-?

(A) Square planar (C) Octahedral

(B) T – shaped (D) Trigonal bipyramidal

54. What hybridization change, if any, occurs at the underlined atom in the following reaction?

$CO_2 + H_20 \longrightarrow H_2CO_3$

(A) $sp^2 \longrightarrow sp^3$ (C) $sp \longrightarrow sp^2$

(B) $sp^3 \longrightarrow sp^3d$ (D) No hybridization change observed

55. A chemist creates a buffer solution by mixing equal volumes of a 0.2 molar HOCl solution and 0.2 molar KOCl solution.Which of the following will occur when a small amount of KOH is added to the solution?

I. The concentration of undissociated HOCl will increase.

II. The concentration of OC ions will increase.

III. The concentration of H+ ions will increase.

(A) II only (B) I only (C) III only (D) I & III only

56. Based on the information given in the table below, what is the enthalpy change for the reaction:

$2H_2O_2(g) + S(s) \longrightarrow SO_2(g) + 2H_20(g)$

Substance	ΔHp_f(KJ/MOL)
$H_2O_2(g)$	-150
$SO_2(g)$	-300
$H_20(g)$	-250
S(s)	0

(A) 400KJ (B) -200KJ (C) 200KJ (D) -500KJ

57. Features common to both galvanic and electrolytic cells include which of the following?

I. Oxidation at anode

II. Can perform electrolysis

III. Spontaneous

(A) II only (B) I only (C) III only (D) I & II only

58. Which of the following reactions is **NOT** involved in the contact process, during the production of sulfuric acid?

(A) $SO_2 + O_2 \longrightarrow 2SO_3$

(B) $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

(C) $SO_3 + H_20 \longrightarrow H_2SO_4$

(D) $H_2S_2O_7 + H_20 \longrightarrow H_2SO_4$

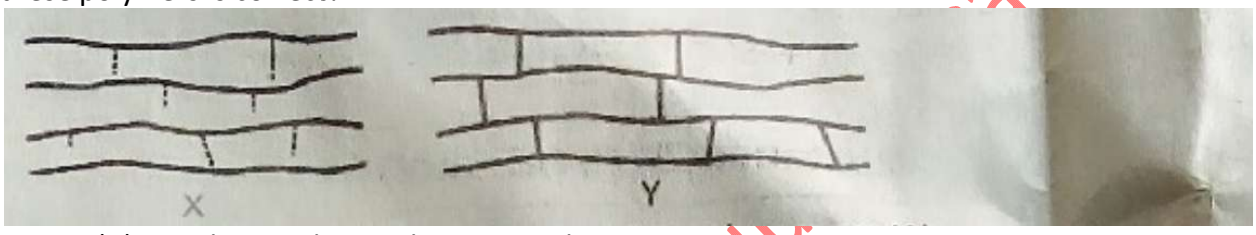
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EXPLANATION: Sulphuric acid is prepared industrially by the contact process, using four steps:

1. $S(s) + O_2(g) \longrightarrow SO_2(g)$
2. $2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$
3. $SO_3(g) + H_2SO_4(l) \longrightarrow H_2S_2O_7(l)$
4. $H_2S_2O_7(l) + H_2O(l) \longrightarrow 2H_2SO_4(aq)$

ANSWER: C

59. Two types of polymer are shown below. When of the following statements concerning these polymers is correct?



(A) X is thermoplastic whereas Y is thermosetting
(B) X thermosetting and Y is thermoplastic
(C) X and Y are thermosetting
(D) X and Y are thermoplastic

60. The energy of an electron in the first Bohr orbit of hydrogen atom is -13.6Ev . The possible value of the excited state for electron in Bohr orbits of hydrogen is _____ .

(A) -6.8eV (C) -4.21eV
(B) -1.51eV (D) +6.8Ev

61. What is the basis for the scientific method?

(A) To formulate a research problem and disprove the hypothesis.
(B) To formulate a research problem, test the hypothesis under carefully controlled conditions that challenge the hypothesis.
(C) To test hypotheses in conditions that are favourable to their success.
(D) To test hypotheses and if the are disproved, they should be abandoned completely

62. For which of the following half-cells is the reduction potential E independent of the PH of the solution?

(A) $Co^{2+} + 2e^- \rightleftharpoons Co$
(B) $H2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$
(C) $[NO_3]^- + H_20 + 2e- \rightleftharpoons [NO_2]^- + 2[OH]^-$
(D) $[Cr_2O_7]^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_20$

63. A certain current produces 0,50g 0f hydrogen gas in 2.0 hrs. What is the amount of copper librated from a solution of copper sulfate by the same current flowing for the same time?

(A) 31.8g (B) 15.9 g (C) 63.6g (D) 6.36g

64. Consider the following equilibria:

(I) $HCO_3^- + H_2O \rightleftharpoons H_2CO_3 + OH^-$

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(II) $NH_4^+ + H_2O \rightleftharpoons H_3O^+ + NH_3$

(III) $HSO_3^- + H_3O^+ \rightleftharpoons H_2O + H_2SO_3$

In which of the equilibrium (equilibria) does water act as Bronsted - Lowry base?

(A) I only (B) II & III (C) II only (D) I, II, III

65. Given the following unbalanced equation

$KMnO_4 + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + I_2 + H_2O$

How many grams of KMnO4 are needed to make 250 mL of 0.20N solution?

(A) 1.58 g (B) 3.16g (C) 2.98 g (D) 3.95g

66. A solution of 10.0 mL of 0.05 M nitrous acid (HNO2- ; pka = 3.34) is titrated 0.050M KOH. What is the PH of the solution after 10mL KOH has been added?

(A) 6.68 (B) 3.34 (C) 10.02 (D) 13.36

67. Which of the following metals cannot be electroplated on to the surface of another metal using an aqueous electrolyte?

$E^0(Ni^{2+}/Ni) = -0.28$ V ; $E^0(Cu^{2+}/Cu) = 0.34$ V,

$E^0(Mg^{2+}/Mg) = -2.37$ V: $E0(Ag^+/Ag) = 0.80$V

(A) Ni (B) Cu (C) Ag (D) Mg

68. What is the freezing point of a solution of 250g of $CaCl_2$ in 1.0Kg of water?

(K_f for H_2O = 1.86 Kg/mol)

(A) -1.3^0C (B) -6.5^0C (C) -9.0^0C (D) -13^0C

EXPLANATION: First we find number of moles of $CaCl_2$

molecular mass of $CaCl_2$ = 110g/mol

$$\text{Number of moles of } CaCl_2 = \frac{250}{110} = 2.27\text{mol}$$

$\Delta T_f = T - T_f$, $T = 0.00$ for water, $\Delta T_f = K_f m$

$$\text{Molality} = \frac{\text{Number of moles of solute}}{\text{Weight (kg) of solvent}} = \frac{2.27}{1} = 2.27 \text{ mol/Kg}$$

$\Delta T_f = K_f m = 1.86 \times 2.27 = 4.22^0C$

$\Delta T_f = T - T_f$, $T = 0$ for water.

69. Which of the following compounds is the least soluble in water?

(A) $(NH_4)_2CO_3$ (B) $Fe(NO_3)_3$ (C) $BaCO_3$ (D) $Na_3(PO_4)$

70. In three different experiments the following results were obtained for the reaction A $\longrightarrow$ products: $[A]_0 = 1.00$ M ,$t_{1/2} = 50$min: $[A]_0 = 2.00$ M, $t_{1/2} = 25$min : $[A]_0 = 0.5$ M, $t_{1/2} = 100$min. What is the value of the rate constant for this reaction?

(A) 0.020 L $mol^{-1}min^{-1}$ (C) 0.030 L $mol^{-1}min^{-1}$

(B) 0.010 L $mol^{-1}min^{-1}$ (D) 0.040 L $mol^{-1}min^{-1}$

71. Which of the following molecules has the largest dipole moment?

(A) CO (B) HCN (C) HF (D) HCl

72. Arrange the following molecules in the order of increasing stability.

(A) $N_2^{2-} < N_2^- = N_2^+ < N_2$ (C) $N_2^{2-} < N_2^- < N_2 < N_2^+$

(B) $N_2^+ < N_2 < N_2^- < N_2^{2-}$ (D) $N_2 < N_2^+ = N_2^- < N_2^{2-}$

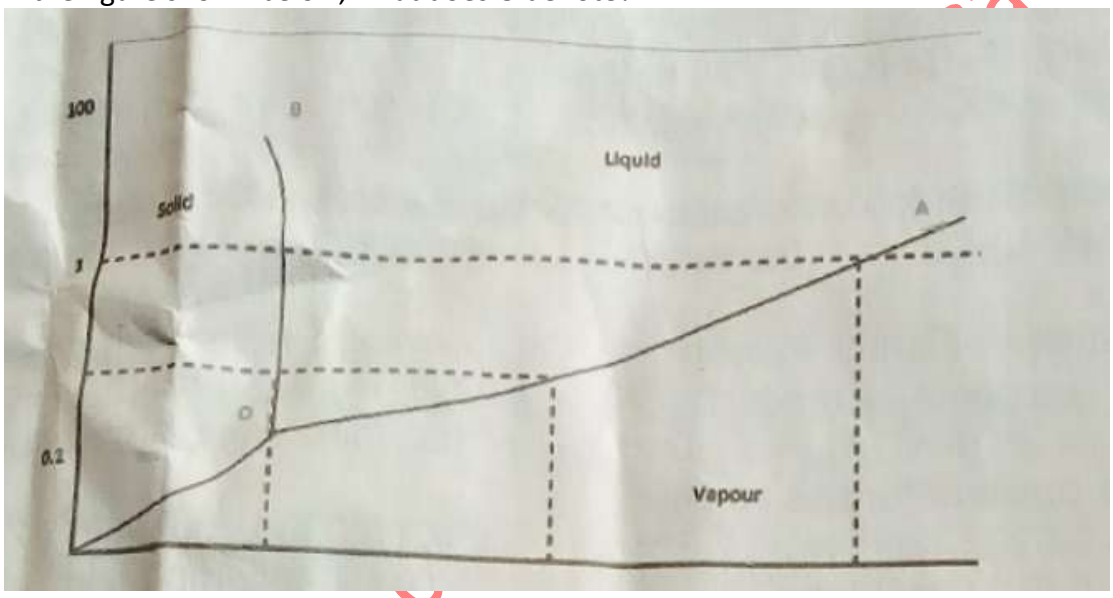
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73. The reaction below takes place with all of the reactants and products in a gaseous phase. Which of the following is true of the relative rates of disappearance the reactants and appearance of the products?

$$2NOCl \longrightarrow 2NO + Cl_2$$

(A) NO appears at twice the rate that NOCl disappears.
(B) NO appears at the same rate that NOCl disappears.
(C) NO appears at half the rate that NOCl disappears.
(D) Cl_2 appears at twice the rate that NOCl disappears.

74. In the figure shown below, what does O denote?



(A) Melting point
(B) Boiling point
(C) Triple point
(D) Vaporization point

ANSWER: C

75. During esterfication of carboxylic acid with alcohol which bond of carboxylic acid undergoes cleavage?

(A) O – H (B) C = H (C) C – O (D) C – C

EXPLANATION: During esterfication of carboxylic acid with alcohol C – O bond of carboxylic acid undergoes cleavage

ANSWER: C

76. If 49 grams of H_2SO_4 react with 80.0 grams of NaOH, how much reactant will be left over the reaction is complete?

(A) 24.5 g H_2SO_4
(B) 20.0 g NaOH
(C) 60.0 g NaOH
(D) 40.0 g NaOH

77. What is the change in internal energy of a system that releases 12.4 J of heat and does 4.2 J of work on the surroundings

(A) 16.6 J (B) -16.6 J (C) 8.2 J (D) -8.2 J

SOLUTION: since the system releases, heat q is negative, q = -12.4J

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And the system does work, work is negative, W= -4.2J

$\Delta E = q + W$

= (- 12.4J) +(- 4.2J) = -16.6J

ANSWER: A

78. Which one of the following is true?

(A) Entropy increases when a liquid freezes at its melting point.

(B) For a spontaneous process ΔG > 0.

(C) For a spontaneous process ΔG < 0.

(D) Entropy of the pure crystalline solid is zero at 0^0c

EXPLANATION: For a spontaneous process ΔG < 0.

Entropy decreases when a liquid freezes.

Entropy of a substance is at 0 K(0 Kelvin)

ANSWER: C

79. Which of the following has the same number of significant figures as the number 1.00310?

(A) 100 (B) 1X105 (C) 5.119 (D) 199.791

EXPLANATION: 1.00310 has 4 significant figures. from the above alternative 5.119 has 4 significant figures

ANSWER: C

80. When an electron in a hydrogen atom makes the transition from the n= 4 state to the N= 2 state, blue light with a wavelength of 434 nm is emitted. Which of the following expressions gives the energy released by the transition?

(A) $\frac{(6.63X10^{-34})}{(4.34X10^{-7})(3.00X10^{8})}$ joules

(C) $\frac{(6.63X10^{-34})(4.34X10^{-7})}{(3.00X10^{8})}$ joules

(B) $\frac{(6.63X10^{-34})(3.00X10^{8})}{(4.34X10^{-7})}$ joules

(D) $\frac{(4.34X10^{-7})}{(6.63X10^{-34})(3.00X10^{8})}$ joules

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